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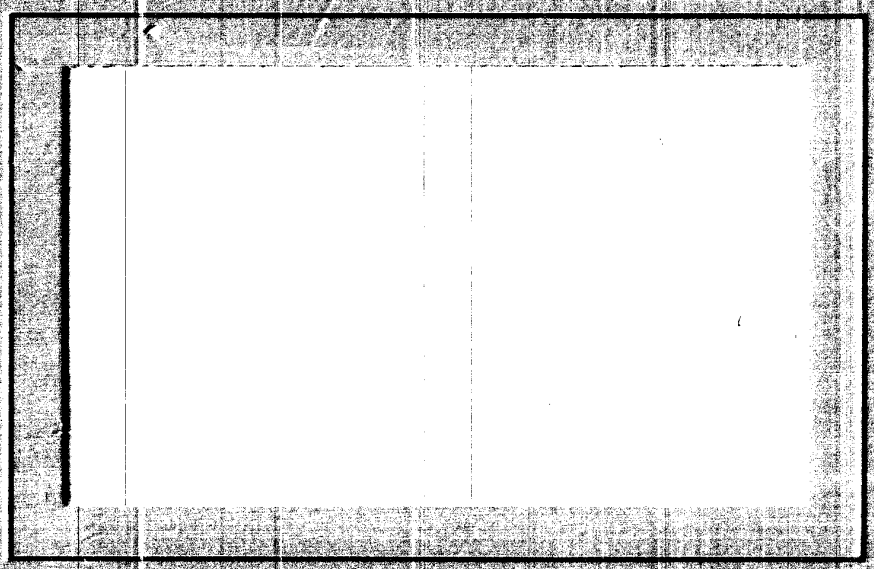

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SUMMARY REPORT

ON

WORK ORDER NO. IV,
TASK ORDER NO. TT

February 28, 1961

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

SUMMARY REPORT

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INTRODUCTION

Recent efforts under Task Orders Nos. Z and RR have resulted in the development of prototype incinerators of two sizes for the destruction of classified papers and documents. Two prototype units of the larger incinerator, the Model 1, have been evaluated by the Sponsor under field conditions for the past year or more, and these have performed quite satisfactorily. Four additional Model 1 units have been produced for the Sponsor by a commercial fabricator; some of these have been and are being installed in the field. The first prototype unit of the smaller incinerator, the Model 2, is now undergoing further evaluation by the Sponsor; a second unit incorporating improved flexibility with regard to motor-blower-assembly operation is under development as part of the current Task Order No. RR effort.

These incinerator units are light in weight and are constructed entirely of metal. Air-film cooling is employed to prevent the metal combustion chamber from reaching excessive temperatures. High-velocity combustion-air jets are used to promote agitation of the stacked paper in order to achieve high burning rates, particularly for the emergency destruction of paper. The vigorous agitation of the burning paper, however, carries much of

the ash or mineral content of the paper and small flakes of black char out of the incinerator with the hot flue gases. This effluent is objectionable because it represents a visible plume, and also the particles of fine ash and small flakes of black char settle out on the ground in the surrounding area.

The general design and operating characteristics of these incinerators appear to be well suited for the originally intended emergency destruction of paper as well as for routine daily use. Therefore, the Sponsor feels that such units would be installed in many areas, including many where emission of fly ash from the flue pipe would have to be materially reduced in order to meet local air-pollution regulations or to avoid complaints from neighbors.

In recognition of this situation, over a year ago, research efforts* under Work Order No. II, Task Order No. KK, were directed toward the cursory investigation of a relatively simple dust collector, called a "fly-ash skimmer". This experimental device utilized the centrifugal force inherent in the spinning gas discharged into the stack of the Model 1 unit, to throw the heavier particles of ash and char toward the periphery of the stack. There, the particles were skimmed off along with about 10 per cent of the flue gas and passed through a cyclone separator. This cyclone separator was sized to handle only 10 per cent of the total flow; thus, it was much smaller than one which could have been designed to pass all of the flue gas from the unit. The benefits of the small size of the collector and of the low flow and power requirements for an auxiliary blower to operate the small cyclone (as compared to those, respectively, for a full-flow cyclone) made this device worthy of consideration.

*For additional details see the "Summary Report on Task Order No. Z", dated May 1, 1960.

Unfortunately, the collection efficiency of this skimmer was only about 30 per cent for the mineral ash content. This was not sufficient to reduce the fly-ash emission to concentrations which would be acceptable under most municipal codes, or to decrease significantly the visible haze caused by the very-small-sized fly-ash particles. However, the small pieces of black char normally present in the stack gas were effectively collected by the skimmer; a considerable reduction was effected in the amount of particles which fell on the ground in the immediate vicinity of the incinerator.

Thus, there was a need for a gas-cleaning method capable of tolerating the high flue-gas temperature and still achieving a relatively high collection efficiency of up to 90 per cent of the fly ash, which included many very small particles. Consequently, an investigation was set up under Work Order No. IV, Task Order No. TT; this provided for a preliminary engineering evaluation of commercially available dust collectors which appeared to be suitable for minimizing the emission of fly ash from the Model 1 and Model 2 incinerators. Specifically, the objectives were (1) to define the gas-cleaning requirements as closely as possible; (2) to consider the technical suitability of all commercially available dust collectors; (3) to obtain technical and cost information from manufacturers of selected equipment; (4) to evaluate manufacturers' claims based on the anticipated requirements; (5) to consider the possibility of modifying the more suitable methods or equipment, if necessary, to meet the specific requirements; and (6) to make recommendations regarding any additional effort which should be performed in order to apply the most suitable gas-cleaning equipment for use on the Model 1 and Model 2 incinerators.

This report summarizes the research conducted under Work Order No. IV, Task Order No. TT, during the period September 12, 1960, through February 28, 1961.

SUMMARY AND CONCLUSIONS

In this preliminary engineering evaluation of dust-collecting methods and equipment, several factors pertaining to the applicability of appropriate units to the specialized Model 1 and Model 2 incinerators were considered. Subsequently, the following tentative requirements for gas-cleaning equipment were established:

(1) Collection efficiency of about 80 to 90 per cent.

(2) Pressure loss to be a maximum of 4 inches of water.

(3) Temperature and corrosion resistance to be adequate for a service life of about 5 years.

(4) Minimum need for auxiliary equipment, utility services, and installation effort.

(5) Reasonably low cost, size, and weight.

On the basis of these tentative requirements, dry-type dust collectors were judged to be more suitable than wet-type collectors, because a supply of water, necessary for the operation of wet collectors, would probably not be available under service conditions. Of the dry-type collectors, the cyclone collector was selected for further exploration; it appeared to satisfy best the requirements of dust abatement and operating conditions for these incinerators.

The replies to inquiries sent to selected manufacturers showed that suitable, stainless steel cyclones are available commercially from Aerotec Industries, Inc., and the Ducon Company; these fall within a price range of from $1,400 to $1,800 each for the unit to be used with the Model 2 incinerator, and from $2,400 to $4,300 each for the unit to be used with the Model 1 incinerator. These collectors are somewhat larger than the respective incinerators; modifications in the design of the conventional ash hopper might be desirable in order to minimize the over-all height of the collectors.

Because during normal intermittent-batch burning the flue-gas temperature is high and fluctuates considerably, and also the gas-flow rate varies widely, this application may be at the fringe of conventional cyclone usage. Therefore, it is recommended that a cyclone be evaluated experimentally in this application before any further planning or procurement is initiated.

REQUIREMENTS FOR A SUITABLE DUST COLLECTOR

A specific dust collector or gas-cleaning method would be suitable for use with the Model 1 or Model 2 incinerator if it could meet several requirements. These are discussed below.

Collection Efficiency

A satisfactory dust collector should be capable of reducing the emission of fly ash to a concentration so low that the fly ash would not be regarded as a nuisance by the operators or the neighbors. This maximum tolerable concentration, or dust load in the effluent gas, may not be clearly defined in some localities; but, in the U. S., the limit recommended by the

American Society of Mechanical Engineers is typical for many cities which have air-pollution-abatement codes. The ASME Code allows a maximum of 0.85 pound of fly ash per 1,000 pounds of stack gas after the quantity of gas is corrected to a dilution corresponding to 50 per cent of excess combustion air. On this basis, calculations reflecting the dust emission from the Model 1 and Model 2 incinerators show that a relatively high collection efficiency of 91 per cent would be needed to meet this fairly stringent air-pollution code. We believe, however, that a collection efficiency in the range from 80 to 85 per cent may be sufficient for satisfactory abatement of the dust nuisance.

The sizes of fly-ash particles from the incinerators of interest encompass a broad range. The largest particles consist of thin flakes of charred paper having a maximum dimension of about 1/4 inch, and the smallest are probably less than 1 micron in diameter. Existing data on size analyses of fly ash from other types of incinerators were used in making the following estimate of particle sizes for the fly ash from the Model 1 and Model 2 incinerators:

Size Range, microns	Per Cent by Weight
0 - 1	3
1 - 10	17
10 - 100	60
Above 100	20

Individual particles less than 10 microns in diameter cannot be seen with the naked eye; but, they contribute significantly to the visibility of a plume because of their excellent light-scattering ability as compared to that of larger particles. In most types of collectors, the larger particles are separated more efficiently than are the smaller particles. Thus, a visible

plume may still prevail at the exit of a dust collector which has an average collection efficiency of 80 to 85 per cent by weight for all particles, because of the appreciable fraction of ash particles which are less than 10 microns in diameter.

In the usual application, the volume flow rate of gas into a dust collector is relatively constant. Because of the intermittent batch-type operation of the Model 1 and Model 2 incinerators, the flow of air is interrupted during feeding, and the volume flow rate also fluctuates widely as a result of varying gas temperatures. In connection with this application, it is important, therefore, that a dust collector be capable of tolerating fluctuating gas-flow rates while still maintaining satisfactory collection efficiency.

Pressure Loss and Power Consumption

If a dust collector was connected to a Model 1 or Model 2 incinerator, the added resistance to the flow of flue gases would increase the back pressure acting on the incinerator. Such an additional pressure loss should be kept as low as possible, in order to minimize any corresponding increase in the pressure from and power to the motor-blower assembly. On the other hand, the collection efficiency of most types of gas-cleaning equipment increases with increased pressure loss. In view of these considerations, we estimate that a collector-pressure loss of up to 4 inches of water at normal burning rates may be needed in order to satisfy the efficiency requirement.

The present No. 25 MW blower with 15-1/2-inch-diameter wheel and the associated 7-1/2-horsepower electric motor, currently used with the Model 1 incinerator, has enough reserve pressure and motor power at the 60-cycle speed

of 3,500 rpm to overcome an added collector-pressure drop of about 4 inches of water when a medium-length incinerator stack is used. Thus, instead of dissipating the reserve pressure by operating with a partially closed damper as in the present practice with no collector being used, the damper would be set in the full-open position when the collector was being utilized as part of the system. At the 50-cycle speed of 2,900 rpm, the blower output is decreased and thus the burning rate would decrease by about 15 to 20 per cent if a collector was in the system. If the blower wheel was increased to the maximum design diameter of 17-1/2 inches, the blower pressure would increase by about 2.8 inches of water. The decrease in burning rate at the 50-cycle speed with the collector used then would be only 5 per cent; further, the present 7-1/2-horsepower motor would be adequate for the 17-1/2-inch-diameter wheel at 2,900 rpm.

The present No. 17 MW blower with 11-5/8-inch-diameter wheel and a 2-horsepower electric motor, currently used on the Model 2 incinerator, has a reserve pressure of about 3 inches of water at the 60-cycle speed of 3,500 rpm when a medium-length incinerator stack is used. By utilization of a wheel of maximum design diameter of 12-1/4 inches, the reserve pressure would be about 4 inches of water and the present 2-horsepower motor would provide adequate power. This would maintain normal air flow and burning rate for a Model 2 incinerator with a collector when the system was operated on 60-cycle power; for 50-cycle installations, the reduced blower speed and consequently reduced output would result in a decrease of about 15 to 20 per cent from the normal burning rates. However, a different blower-drive arrangement could be used with 50-cycle power to maintain the blower speed at 3,500 rpm, in order

to obtain normal burning rates; this would be a belt drive, involving a belt and pulleys.

The above considerations pertaining to increasing the blower pressure in order to compensate for collector operation are based on an altitude of about 1,000 feet. It is expected that burning rates would decrease with increased altitude during operation with or without a collector. However, the reserve capacity of the present motor-blower assemblies can be used for only one purpose, namely, either for maintaining normal burning rates at high altitudes without the collector being used, or for overcoming the collector-pressure loss at normal or low altitudes. If it is necessary to maintain normal burning rates in an incinerator-collector system at high altitudes, then an increase in the blower size or speed, and possibly a change to a higher capacity electric motor, will be needed.

Some types of dust collectors include a built-in pressure booster, such as a blower or an ejector, which serves to overcome the resistance to flow through the collector. Thus, the necessity for altering the present motor-blower assemblies as outlined above could be avoided by means of such a device; but, the additional power consumed by the booster would have to be provided.

Temperature and Corrosion Resistance

A dry-type dust collector for the incinerators of interest would have to be able to withstand inlet-gas temperatures which fluctuate repeatedly between 600 and 1800 F. The inlet gases could be cooled by dilution with air or by water sprays, but it would be desirable to avoid this complication if

possible. Obviously, low-cost mild-steel construction would not satisfy these requirements. A high-alloy stainless steel, such as the Type 310 stainless steel used for the liner and stack of the incinerators, would probably give satisfactory service.

In a wet collector, or water scrubber, the flue gases are cooled immediately to less than 200 F. Therefore, temperature-resistant materials are not needed. However, costly, corrosion-resistant construction may be required, in order to resist attack from possibly acidic gases absorbed by the water.

In any event, it appears desirable for the selected collector to have sufficient temperature and corrosion resistance so that a useful service life of about 5 years could be expected.

Auxiliary Equipment and Utility Services

An ideal dust collector for these incinerators would be a "package unit" which could be installed easily and quickly with a minimum of auxiliary-equipment and utility-service requirements. The installation and use of a dust collector will probably involve at least some of the following:

(1) A connecting duct between the incinerator and dust collector; this may be different for each installation.

(2) Suitable provisions for thermal expansion of the duct.

(3) A discharge duct from the collector.

(4) An arrangement whereby the elevation at the end of the discharge duct would be about 10 feet above the top of the incinerator, to provide natural draft (as in the case of a chimney); if only horizontal ducting is used, the flow resistance added by a dust collector might result in the escape of flames through the open door of the incinerator during the feeding period.

(5) A heat shield around a dry-type collector, to minimize the buildup of excessive ambient temperatures, particularly if the incinerator-collector system is located indoors.

(6) An accumulating chamber, and dustless storage and handling facilities, for use in the disposal of fly ash from a dry-type collector.

(7) Provision for discharging the slurry of ash and water from a wet scrubber into a sewer, or to follow a more usual practice, provision of a settling chamber or pond, to permit separation of most of the solids before discharging the water into a sewer. In this connection, an arrangement might also be set up for pumping the cleaned water, so obtained, back to the scrubber, in order to minimize the consumption of fresh water.

(8) Provisions for handling the flow of water, if all fresh water is to be used. In this case, about 5 and 15 gallons per minute would be needed for the Model 2 and Model 1 incinerators, respectively; these flows could be handled using 1/2-inch and 1-inch pipe and connections.

(9) Provision of utility-service connections for steam, compressed air, or electricity, if a pressure booster is used.

(10) Provision for emergency operation during periods when normal utility services such as electricity and water are unavailable. On the basis of present planning, gasoline-engine standby power for the blowers of both incinerators will be available; this would handle the pressure drop imposed by the use of a dry-type collector under emergency conditions and additional provisions for emergency operation would not be required. However, unless specific arrangements were made to provide water and/or another source of standby power, a wet-type collector, or a collector which required a separate

pressure booster, would have to be disconnected or bypassed during emergency periods. This could be done by utilizing a valve with a bypass duct, installed ahead of the collector.

Size, Weight, and Cost of Collectors

The size and weight of the Model 1 and Model 2 incinerators are small compared to those, respectively, of conventional refractory-lined incinerators of the same burning capacity. Likewise, the volume flow rate of flue gases is large relative to the size of these specialized paper-burning incinerators. It is important, therefore, that the size and weight of a suitable dust collector also be as small as possible, in order to provide a practical accessory for the incinerators. The use of a small-sized collector necessitates high gas velocity, which results in increased pressure loss and power requirements; but, it has an advantage of increased collection efficiencies, especially if a dry-type collector is used.

The cost per pound for these specialized light-weight incinerators of interest is relatively high because of the extensive use of heat-resistant stainless steel in the construction. As mentioned above, dry-type collectors probably also will require the same type of heat-resistant construction material. It is considered that a reasonable goal for first or original cost of a suitable dust collector would be approximately the same as the cost of the incinerator. Operating and maintenance costs must also be considered in the over-all comparison of suitable dust-collection equipment. Low original cost is, of course, desirable, but is not considered to be so important as many of the other requirements described above.

APPRAISAL OF COMMERCIAL DUST COLLECTORS

Table 1 indicates our qualitative appraisal of the suitability of commercially available dust collectors for use with the Model 1 and Model 2 paper incinerators. In the first column, various kinds of collectors are classified as dry or wet types. Water sprays can be used for cooling the gas, by evaporation, in dry-type collectors, but the dust remains dry. Wet collectors use sufficient water to (1) cool the gas, (2) wet the dust particles, and (3) discharge the liquid water - dust suspension or slurry.

The other column headings in Table 1 identify the requirements which were discussed previously. Ratings of the suitability of each kind of collector were arrived at on the basis of a relative scale from A to E. A rating of A means the most suitable, and E the least suitable; intermediate letters indicate intermediate suitability. At the bottom of Table 1 an estimate is given, under each requirement, for a tentative minimum rating which should be met in order for a particular type of collector to qualify for possible application. All ratings were based on (1) information obtained from the technical literature on gas cleaning, (2) manufacturers' bulletins, and (3) on our past experience in gas-cleaning research. Detailed descriptions of each type of equipment are not included here, but can be found in a number of standard publications listed in the "References".

Dry-Type Collectors

An examination of the suitability ratings of the dry collectors in Table 1 shows that only two types, namely, one large-diameter cyclone (No. 4) and several small-diameter cyclones (No. 5), meet all of the tentative

TABLE 1. SUITABILITY OF COMMERCIAL DUST COLLECTORS

Type	Over-All Suitability	Collection Efficiency	Pressure Loss and Power Consumption	Temperature and Corrosion Resistance	Auxiliary Equipment	Utility Services	Space Occupied	Maintenance	First Cost
Dry-Type Collectors									
1. Simple settling chamber(1)	B-	E	A	B	B	A	E	A	B
2. Baffle chamber(1)	B-	D	A	C	B	A	D	B	B
3. Louver (skimmer type)(2)	C+	D	B	C	C	B	A	C	B
4. Large-diameter cyclone(2)	B	C	C	B	B	A	B	A	B
5. Several small-diameter cyclones(2)	B-	B	C	C	B	A	B	B	C
6. Mechanical centrifugal separator(3)	C	C	A(5)	D	D	C	C	C	C
7. Filter, cloth bag(3)	C+	A	B	C	D	B	C	D	D
8. Filter, ceramic fiber mat(1)	C-	A	B to D(4)	B	D	B	D	E	D
9. Electrostatic precipitator(3)	C-	A	A	C	D	C	D	C	E
Wet-Type Collectors									
10. Simple spray chamber	C+	C	A	B	C	D	C	C	B
11. Venturi scrubber	C-	A	E	B	C	D	B	C	D
12. Cyclonic scrubber	C+	B	D	B	C	D	B	C	C
13. Impingement scrubber	C+	B	D	B	C	D	B	C	C
14. Rotor scrubber	C+	B	A(5)	C	B	D	B	C	D
15. Packed scrubbing tower	C-	B	C	B	C	D	D	C	D
16. Wet filter	C-	B	B to D(4)	B	C	D	C	E	C
Minimum rating for suitability	-	C	C	C	B	A	B	B	-

Note: Ratings of A, B, C, D, and E show estimated relative suitability for this application. An A rating indicates the best suitability; E, the worst suitability; and an intermediate-letter rating, intermediate suitability.

(1) Refractory or heat-resistant-alloy construction would be needed to resist the high flue-gas temperatures.
(2) Heat-resistant stainless steel construction would be needed to resist the high flue-gas temperatures.
(3) The flue gases would have to be cooled by air dilution or water sprays for application of this collector.
(4) Progressive increase in pressure drop, and eventual plugging, would be a problem with this unit.
(5) This collector is basically a centrifugal blower, which imposes no pressure loss; but, power is required for the electric motor needed to operate this unit.

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minimum ratings. The large-diameter cyclone has the highest over-all suitability rating of B, whereas the other type has a B- over-all rating. Each of these two types is worthy of further consideration, mainly because it is relatively small and could be supplied as a "package unit" which would require minimum installation effort and no utility services during either routine or emergency operation of the incinerators. It is expected also that these two types of collectors would have adequate collection efficiency for most locations as long as the units were designed for a maximum pressure loss of 4 inches of water. Further effort in connection with the selection of specific equipment is described later in this report.

Wet-Type Collectors

The collection efficiencies of wet collectors may indeed be higher than those of the above-listed dry types, particularly during periods of dampered flow of the combustion air. However, the disadvantages of water scrubbers in this application are quite decisive. It is considered extremely unlikely that a reliable supply of water and a means for disposing of the silt-laden water could be provided at many installations where the incinerators would be used. This is reflected in the low ratings in Table 1 for wet-type collectors in regard to auxiliary equipment and utility services required.

Because of the apparent unsuitability of wet collectors, no further effort was devoted to the selection of specific equipment of this type. If the Sponsor were to have an interest in specific installations where the use of wet scrubbers might be feasible, the applicability of specific equipment of this type could be discussed.

Selection of a Specific Dry-Type Collector

A list was compiled of 104 manufacturers who can and do supply dust-collection equipment. After those firms which produce only wet-type collectors were screened out and the others were appraised, a group of nine well-known manufacturers of dry collectors were selected for initial contact.

Pertinent information and requirements for the operation of dust collectors in conjunction with the Model 1 and Model 2 incinerators were described in a letter which was sent to each of the nine manufacturers. A copy of this letter and the list of firms to which this was sent are included in Appendix 1.

Replies were received from all of the firms, and copies of these replies were furnished to the Sponsor. Four firms stated that their dry-type collectors were not suitable for this application. Quotations were received from three firms, and are still expected from the other two companies.

Table 2 shows the quotations and other information supplied by three manufacturers of cyclone dust collectors. Each of the collectors involved in these bids includesa sealed hopper at the bottom; the capacity of the hopper would be sufficient to handle the ash collected during a few hours of operation of the incinerator-collector system.

Aerotec recommended the heavier 12-gage (versus 14 gage) construction mainly to insure against damage during shipment and installation, and not because of any attempts to provide longer service life. American-Standard selected 10-gage construction material to provide ample thickness against erosive wear. Apparently Ducon believed that 14-gage material would satisfy the requirements. We also believe that 14-gage metal would be adequate and would minimize the weight and cost.

TABLE 2. QUOTATIONS ON COMMERCIAL CYCLONE DUST COLLECTORS

Parameter	Aerotec Industries		American-Standard	Ducon
Metal thickness, gage	12	14	10	14
Type of stainless steel	310	310	309	310
Collection efficiency, %	90	90	80-85	80-85
Pressure loss, in. of water	3	3	3	3.3
Collector for Model 2				
Weight, lb	470	340	800	350
Height, ft	10	10	10-1/2	9
No. of tubes	1	1	2	1
Tube diameter, in.	27	27	15	30
Price for one unit, $	1,755	1,494	2,980	1,330
Price each for 10 units, $	1,563	1,348	2,086	1,200
Collector for Model 1				
Weight, lb	1,360	970	1,600	700
Height, ft	11-1/2	11-1/2	11-1/2	13-1/2
No. of tubes	2	2	4	1
Tube diameter, in.	33	33	15	50
Price for one unit, $	4,292	3,556	5,125	2,340
Price each for 10 units, $	3,900	3,190	3,588	2,100
Time for delivery, weeks	12-14	12-14	8-9	8-10

Note: Freight charges would add up to $75 to each of the cost figures indicated.

The claim of 90 per cent collection efficiency by Aerotec is probably the maximum efficiency which is achieved when the gas velocities are highest during the burning cycle. Ducon's claim of 80-85 per cent is the average for an entire cycle. Therefore, the efficiencies as well as the pressure losses for these two brands of collectors probably do not differ appreciably. Actual measurement of collection efficiency and visual observation of the plume during operation of an incinerator would have to be performed, in order to judge the effectiveness of a collector.

It should be noted that the floor space occupied by these collectors and the height are somewhat greater than those, respectively, for each of the incinerators. A clearance of about 2 feet is usually provided between the floor and the cyclone hopper, to facilitate unloading of the ash from the conventional hopper. If this clearance is added in, the over-all height for a Model 2 collector would be 11 to 13 feet; this is higher than the height of most conventional rooms. A short hopper with side discharge could be devised, so as to reduce the over-all height of the collector to about 8 feet. Figure 1 shows the relative size of an installation consisting of a Model 2 incinerator and a Ducon, Type SD, Size 7 cyclone collector with a shortened hopper.

On the basis of our study, either the Aerotec or the Ducon unit could be selected as a suitable collector for this application. Copies of prints which show the design and dimensions of the 2 Ducon collectors for the Model 1 and Model 2 incinerators are included in Appendix 2.

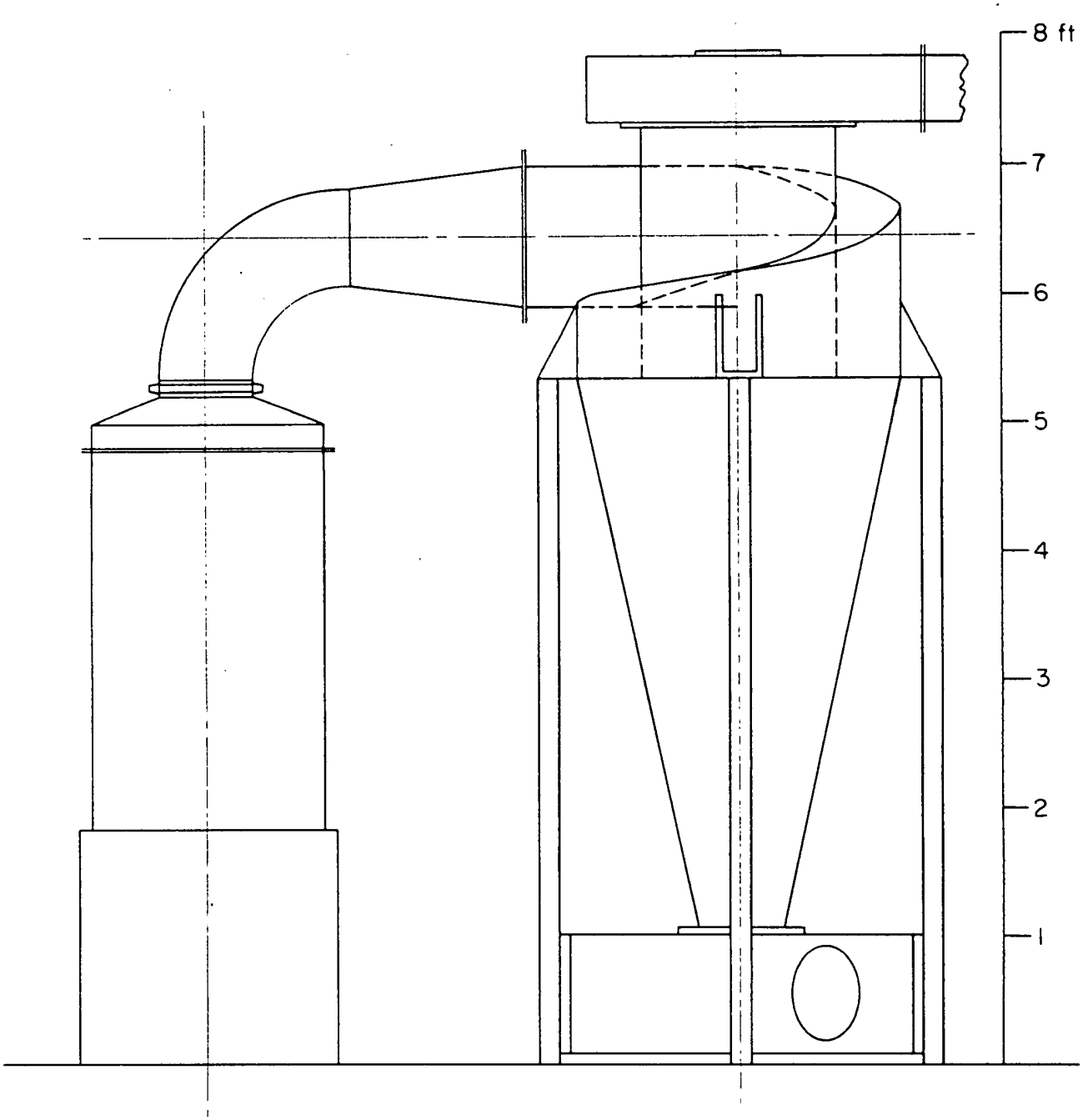

FIGURE 1. RELATIVE SIZE OF THE MODEL 2 INCINERATOR AND A DUCON, SIZE 7 CYCLONE COLLECTOR (WITH SHORTENED HOPPER)

RECOMMENDATIONS FOR FUTURE WORK

It is recommended that a commercial cyclone dust collector be obtained for the Model 2 incinerator and evaluated during experimental operation. This would be desirable in order to provide (1) an actual measure of collection efficiency, (2) a visual evaluation of the effectiveness of the collector, (3) a measure of pressure loss, (4) an indication of any possible adverse effects of the collector on incinerator performance, and (5) a measure of surface temperature as a basis for the computation of the amount of heat given off by the collector.

At the Sponsor's request, a proposal is being prepared to provide for a program of the above-outlined type. It is contemplated that this proposal will be submitted in the near future.

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APPENDIX 1

INQUIRY SENT TO NINE COLLECTOR MANUFACTURERS AND LIST OF MANUFACTURERS CONTACTED

INQUIRY SENT TO NINE COLLECTOR MANUFACTURERS

February 7, 1961

(See list of manufacturers contacted)

Gentlemen:

We wish to purchase two dry-type dust collectors for cleaning the hot flue gases from two sizes of incinerators for disposal of paper and similar dry refuse. Our initial need is for two dust collectors for experimental use, but if results are encouraging, a number of units of each size may be needed.

Each incinerator operates on forced draft, and present blower pressure could be increased by a few inches of water to overcome the additional pressure drop of a dust collector. Operation is batchwise; at intervals of from two to ten minutes, air flow is shut off for about 15 seconds, the incinerator door is opened, and refuse is dumped in manually. During the feeding periods, natural draft from a short stack has provided sufficient inflow of air through the open door to prevent flames from emerging. Similar venting through a dust collector would also be needed.

Because of the batch feeding, both air flow and stack temperature will vary with time, as shown in the attached Figure 1. After feeding, the stack gases are allowed to reach a maximum temperature of 1800 F, which may exist for a few seconds for a small batch or as long as one minute for the largest batch. Immediately after feeding, the air flow may be gradually increased to the maximum, as a means of controlling exit gas temperature. We have considered the use of additional air for cooling of stack gases by dilution, but would prefer to avoid this complication if a dust collector which can tolerate the cycling flue-gas temperature can be obtained.

The following tabulation shows data which you may need in the selection of dust-collection equipment for each of the two incinerators:

	Size 1	Size 2
Maximum flow of gas, lb/hr	12,000	4,000
Dew point of gas, F	100	100
Fly-ash emission, lb/hr	37	13
Flue diameter, in.	16	9
Height at vertical flue collar, ft	7	7

Estimated size consist of fly ash from both units:

Size Range, microns	Per Cent by Weight
0 - 1	3
1 - 10	17
10 - 100	60
above 100	20
	100

In the size range above 100 microns, about one-half, or 10 per cent of the total, consists of thin flakes of charred paper having a maximum dimension of about 1/4 inch. The fly ash itself has a specific gravity of about 2.5.

A compact, light-weight collector would be desirable. Life expectancy for the collector would not be the most important factor, but daily operation for 8 hours per day, over a period of 5 years without replacement, would be desirable. The maximum pressure drop which could be tolerated at full flow and temperature is 4 inches of water. Average collection efficiency of 90 per cent or more would be desirable for the burning cycle.

On each incinerator a short vertical stack, or flue collar, made of 16-gage Type 310 stainless steel extends above the unit to a level of about 7 feet above the floor. In most installations, an elbow would be used above the flue collar to conduct the gases through a horizontal duct.

If you can supply suitable dust-collecting equipment, we would like to receive price quotations for lots of one and ten in each of the two sizes, and the estimated time required for delivery. We would also need technical data concerning physical size and shape, weight, and materials of construction, and your estimate of collection efficiency and pressure drop for the two collectors.

If you need further information, please let me know.

Yours truly,

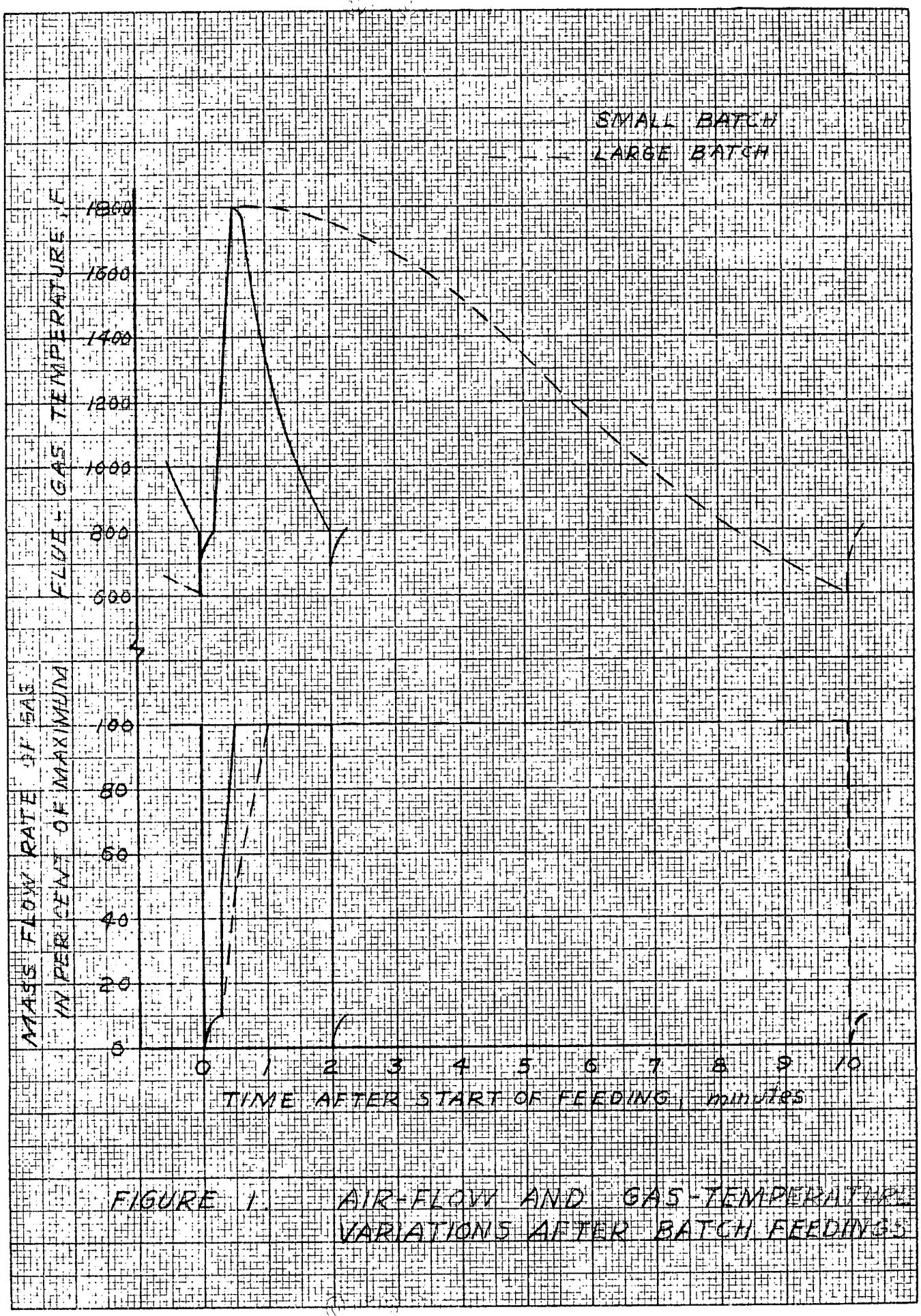


FIGURE 1. AIR-FLOW AND GAS-TEMPERATURE VARIATIONS AFTER BATCH FEEDINGS

LIST OF COLLECTOR MANUFACTURERS CONTACTED

(1) The Ducon Company, Inc.
155 East Second Street
Mineola, New York

(2) The Day Company
862 Third Avenue, NE
Minneapolis 13, Minnesota

(3) John Wood Company
Air Pollution Control Division
Bernardsville, New Jersey

(4) Mr. Fred D. Buckley
Joy Manufacturing Company
869-71 Niagara Falls Boulevard
Buffalo 21, New York

(5) American-Standard
Industrial Division
Tireman Avenue at Roselawn
Detroit 32, Michigan

(6) Dustex Corporation
P. O. Box 2520
Buffalo 25, New York

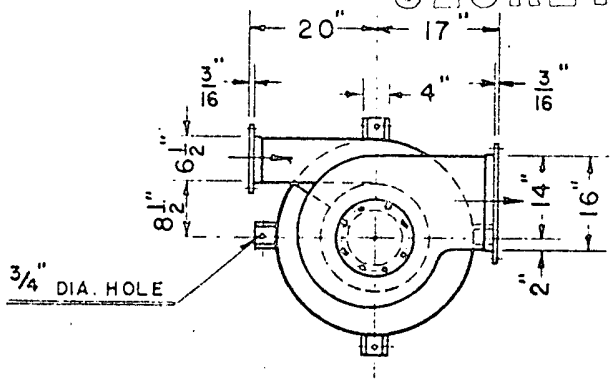
(7) American Air Filter Company
215 Central Avenue
Louisville, Kentucky

(8) Aerotec Industries, Inc.
Greenwich, Connecticut

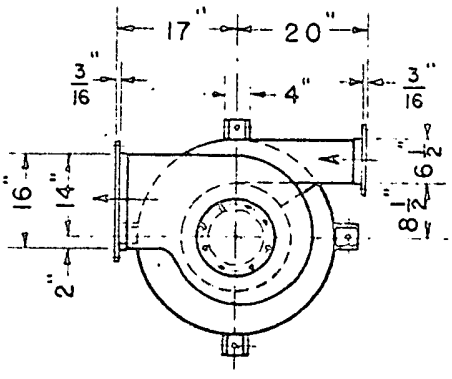
(9) Buell Engineering Company, Inc.
Northern Blower Division
6427 Barberton Avenue
Cleveland 2, Ohio

APPENDIX 2

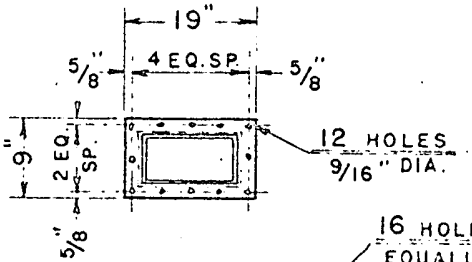
DESIGN PRINTS OF TWO DUCON CYCLONE COLLECTORS



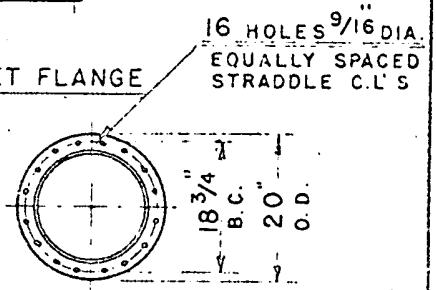
CLOCKWISE
TOP VIEW



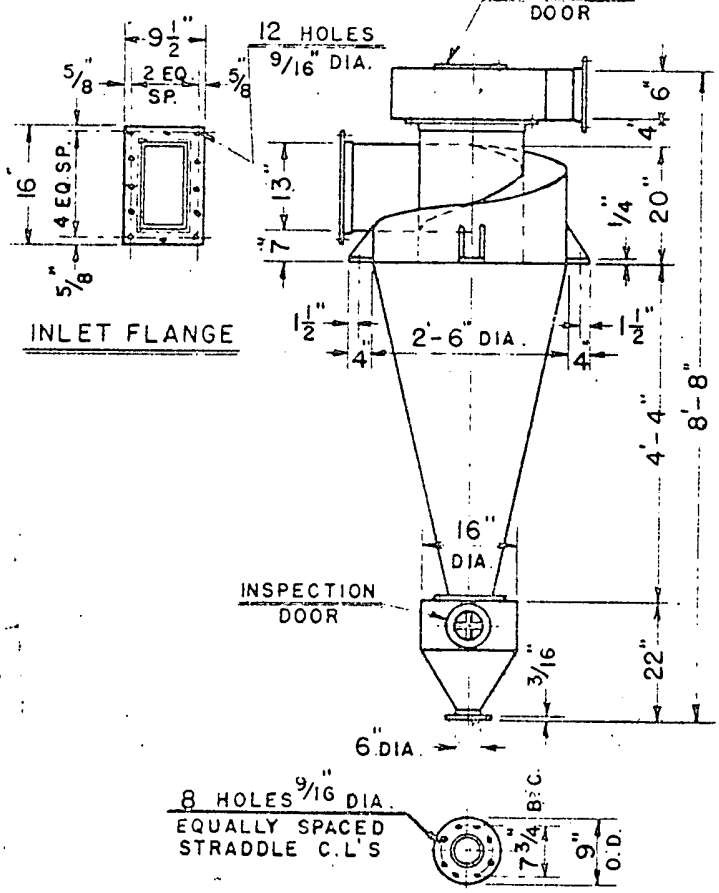
COUNTER CLOCKWISE



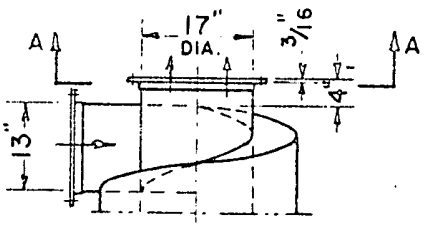
OUTLET FLANGE



VIEW A-A



ELEVATION



CYCLONE WITH
TOP OUTLET

FOR : _____

CONTRACT : _____

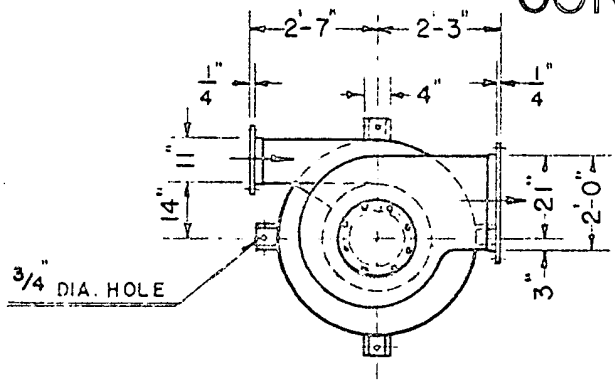
MATERIAL :

APPROX. WEIGHT :

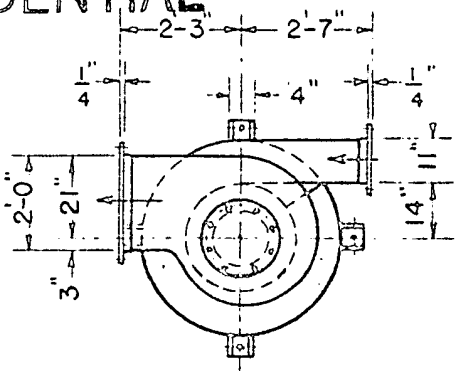
THE DUCON COMPANY
MINEOLA, NEW YORK

CYCLONE COLLECTOR
SIZE 7, TYPE SD

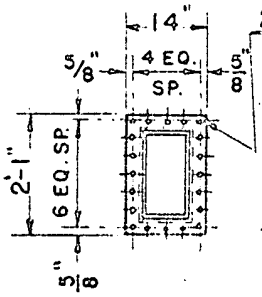
DRAWN TL	DATE 2.24.54	B-1907
SCALE		



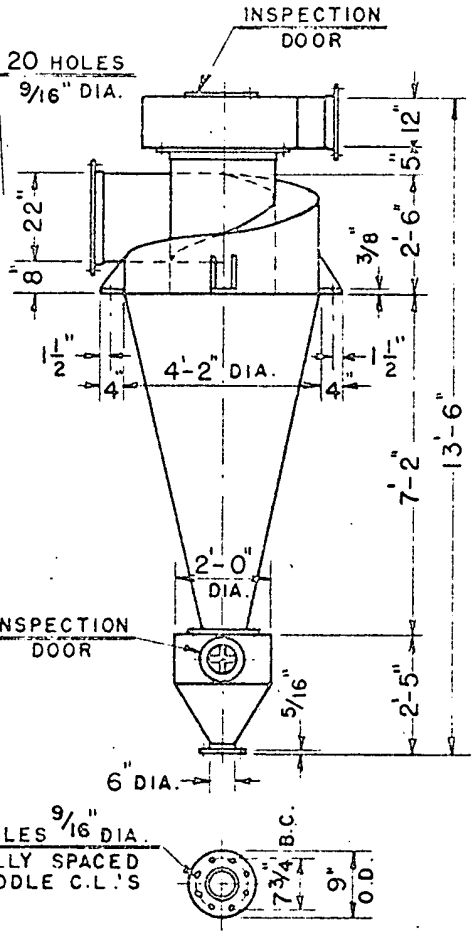
CLOCKWISE
TOP VIEW



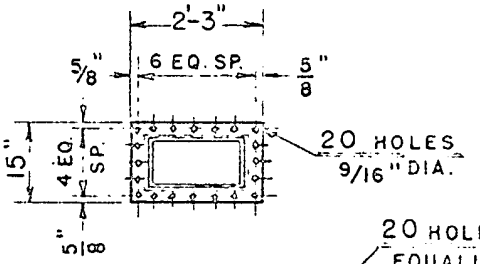
COUNTER CLOCKWISE



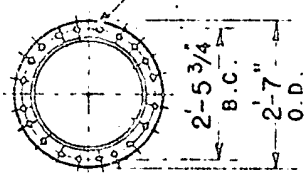
INLET FLANGE



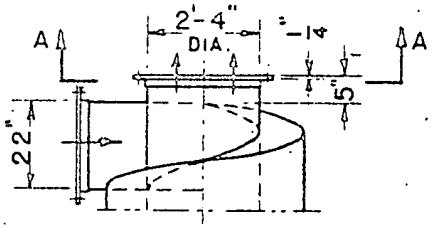
ELEVATION



OUTLET FLANGE



VIEW A-A



CYCLONE WITH
TOP OUTLET

FOR : _____

CONTRACT : _____

MATERIAL :

APPROX. WEIGHT :

THE DUCON COMPANY
MINEOLA, NEW YORK

CYCLONE COLLECTOR
SIZE 12, TYPE SD

DRAWN TL	DATE 2.24.54	B-1912
SCALE		

SECRET

CONFIDENTIAL

SECRET